

Case report

VERTEBRAL METASTASIS OF RENAL CARCINOMA AT DIAGNOSIS. MECHANICAL AND CLINICAL EVALUATION. SURGICAL MANAGEMENT

Metástasis vertebral de carcinoma renal en el momento del diagnóstico. Evaluación mecánica y clínica. Manejo quirúrgico

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ABSTRACT

Renal cell carcinoma accounts for 2-3% of all malignant neoplasms. Metastatic disease of the spine is common and 50% of bone metastases are already present at the time of primary diagnosis. Bone metastases from renal cell carcinoma are difficult to manage, especially vertebral localization.

A 48-year-old woman was diagnosed with renal cell carcinoma in the context of low back pain. The patient presented two skeleton metastases at diagnosis (T11 and 5th rib). The patient received neoadjuvant treatment with cabozantinib, followed by removal of the renal tumor. Radiotherapy

was administered for the lumbar lesion. In spite of the radiotherapy treatment, increased low back pain limiting mobility and ambulation. MRI showed an occupation of the spinal canal, without neurological lesion. The SINS scale revealed a score of 14 (vertebral instability). The patient's prognosis was greater than 12 months according to the Tokuhashi score. Based on clinical and mechanical criteria, surgical treatment of the vertebral lesion was decided. T11 vertebrectomy was performed, the reconstruction was made with an expandable cage, and T8 a L2 posterior spinal arthrodesis. A partial resection of the fifth rib was performed in order to remove the whole macroscopic tumor. After 3 months, she was diagnosed with a local infection, treated by irrigation, debridement and antibiotherapy, with good evolution. At 1-year follow-up, she has no low back pain or functional limitation. Follow-up chest-abdomen-pelvis computed CT scan showed absence of disease progression, furthermore, the vertebral arthrodesis shows fusion signs. At the time of this report, there are no clinical or radiological data of infection.

Keywords: spinal metastases, renal cell carcinoma, spinal instability, spine surgery.

1. Introduction

Bone metastases are the most frequent tumor in the skeleton and their most frequent location is in the spine (McLaughlin & Lipworth., 2000). Renal cell carcinoma (RCC) accounts for 2-3% of all malignant neoplasms. The most frequent location of renal metastases is the lung (50%) followed by the bone (20-50%) (McLaughlin & Lipworth., 2000). Fifty percent of patients have at least one metastasis at the time of diagnosis (Umer, *et al.*, 2018). About 30% of patients with renal cell carcinoma are diagnosed with a pathological fracture (Smith, *et al.*, 1992).

The prognosis of RCC with distant metastatic disease is poor, with a median life expectancy of 12-24 months. In addition, the estimated survival will be lower if the metastasis is located in the spine compared to the extremities. (Smith, *et al.*, 1992). Bone destruction is associated with mechanical instability, intractable pain, radiculopathy and symptoms of cord compression (Smith, *et al.*, 1992).

Bone disease secondary to RCC is difficult to treat. It is a partially resistant disease to chemotherapy and radiotherapy; therefore, en bloc resection should be considered to minimize the risk of local disease progression (Les, *et al.*, 2001). RCC is an extremely vascularized tumor which poses a risk of hemorrhage. This profuse vascularization makes surgical resection hazardous. Embolization of the tumor prior to surgery is recommended (Langdon, *et al.*, 2009).

To decide whether a patient should be treated by palliative surgery or conservatively, the revised Tokuhashi score can be used, which is based on the type of primary tumor and the patient's comorbidities (Tokuhashi, *et al.*, 2005). Indications for surgery in the treatment of metastatic spinal disease due to renal cell carcinoma are the following: solitary osseous metastases with or without compression, and multiple osseous metastases with unilocular cord compression (Giehl & Kluba., 1999). The spinal neoplastic instability score (SINS) assesses spinal stability. This score allows surgical treatment to be indicated independently of other variables such as tumor histology or radiosensitivity (Laufer, *et al.*, 2013b). Surgical treatment of spinal instability allows better pain control and prevents serious neurological complications (Laufer, *et al.*, 2013a, Mendel, *et al.*, 2009).

Indications for surgical treatment of spinal metastases range from spinal stabilization to en bloc resection of the lesion. The gold standard treatment for a solitary spinal metastasis is a total en bloc vertebrectomy (Tomita, *et al.*, 2001, Tomita, *et al.*, 1994). Although vertebral metastasis is not isolated, prophylactic spinal stabilization should be performed when there is a risk of fracture and/or

instability to avoid acute cord compression (Langdon, *et al.*, 2009). Another useful surgical treatment in spinal metastases is cement augmentation, which is indicated in patients with pathological vertebral fractures that do not require cord decompression. Cement augmentation allows the anterior column of the spine to be reconstructed in a minimally invasive procedure (Langdon, *et al.*, 2009, Mendel, *et al.*, 2009).

Goals of surgical treatment are to decrease the patient's pain, to preserve or to regain his or her mobility, as well as to prevent local complications (fracture, neuronal instability and cord compression).

2. Case report

A 48-year-old female presented to our emergency department with back pain at the thoracolumbar junction, which has worsened over the last 3 months. She also mentioned right flank and hypochondrium pain in addition to body weight loss of approximately 5 kg over the past month.

A physical examination did not find a significantly palpable mass in the right abdomen. There was no superficial lymphadenopathy. Neurological examination showed no pathological findings, including a negative Hoffmann sign. Laboratory tests result showed no pathological data. Emergency computed tomography scan revealed a solid tumor lesion (approximately 64 x49 mm) with hyper vascular appearance, congruent with RCC. Bilateral external iliac and inguinal lymphadenopathy was found, in addition to an extracompartmental lytic lesion at the level of T11 which invaded the spinal canal with a pathological fracture of the vertebral body.

The patient was admitted to the oncology department to complete the diagnostic test studies. CT scan of the chest revealed a lesion at the level of right 5th rib. A subsequent CT-BAG confirmed the diagnosis of clear renal cell carcinoma nuclear grade II. The patient was diagnosed with stage IV renal cell carcinoma. The case was discussed at the multidisciplinary oncology board and the patient was included in a clinical trial for the administration of neoadjuvant treatment with cabozantinib prior to cytoreductive radical nephrectomy which were made three months later. Regarding spinal injury, radiotherapy was proposed to treat severe low back pain and to prevent progression of spinal cord invasion.

The patient was referred to Spine Orthopedic outpatient consultation four months after the renal surgery and spine radiotherapy treatment. She related a persistent low back pain instead of pain killers. A physical examination did not find any neurological deficit. Spinal radiographs (**Figure 1**) showed a pathological fracture of T11 with increased thoracic kyphosis with an angle greater than 25°. Thoracic MRI and CT scan (**Figure 2**) revealed a lytic lesion with a vertebral collapse and soft tissue mass involvement the epidural space around T11. The patient was evaluated at the multidisciplinary oncology board where palliative surgical treatment was recommended, based on clinical (Tokuhashi score= 14, life expectancy of ³ 12 months) and mechanical (SINS= 11, vertebral instability) criteria.

The objectives of surgical management in this case were pain control, improving spinal stability and reducing the risk of spinal cord injury.

Figure 1.

X-ray, anteroposterior (A) and lateral (B) views, showing compression fracture of T11.

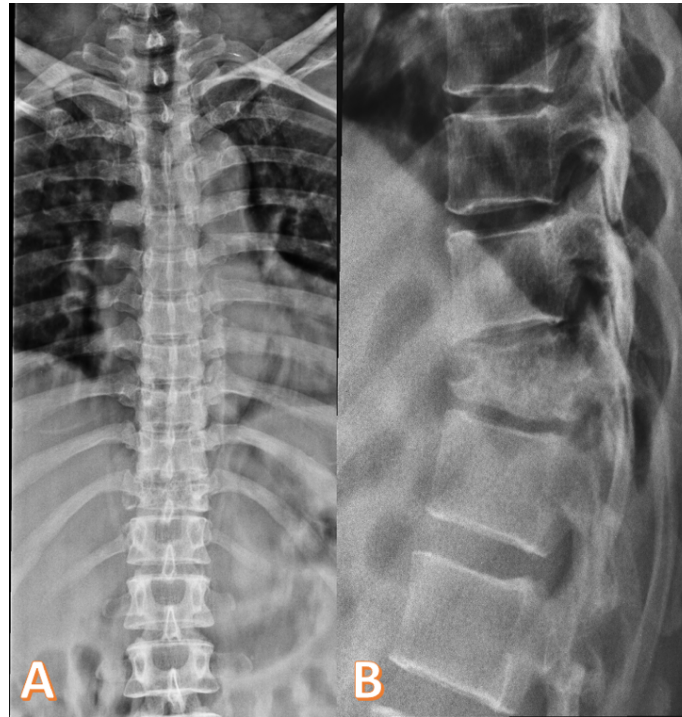
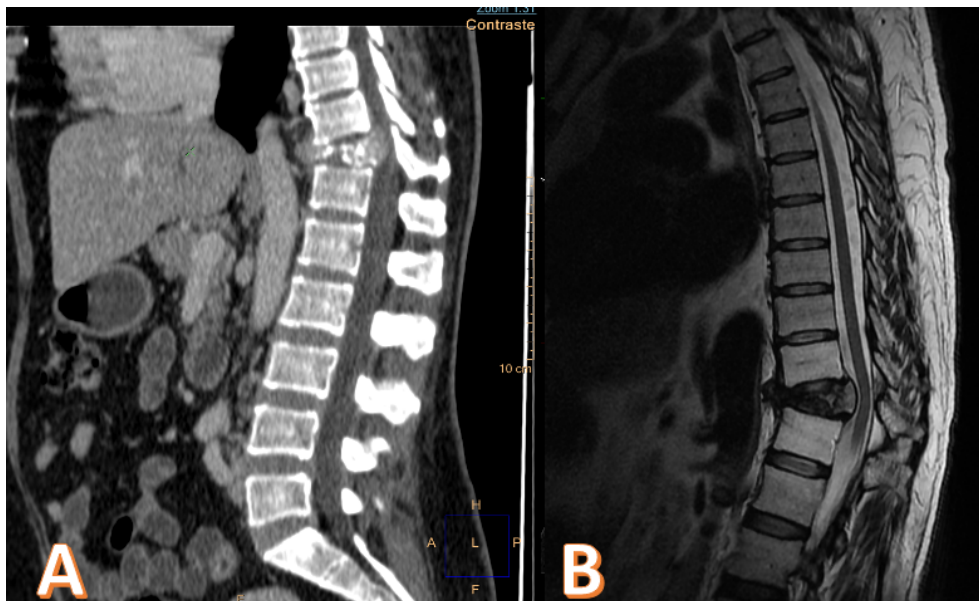


Figure 2.

Thoracic CT scan (A) and RMI(B) revealed a lytic lesion with a vertebral collapse and soft tissue mass involvement the epidural space around T11.



Surgical procedure

The patient was put to sleep using general anesthesia and was placed in prone position. T11 vertebrectomy was performed through a posterior midline approach, thus obtaining a decompression

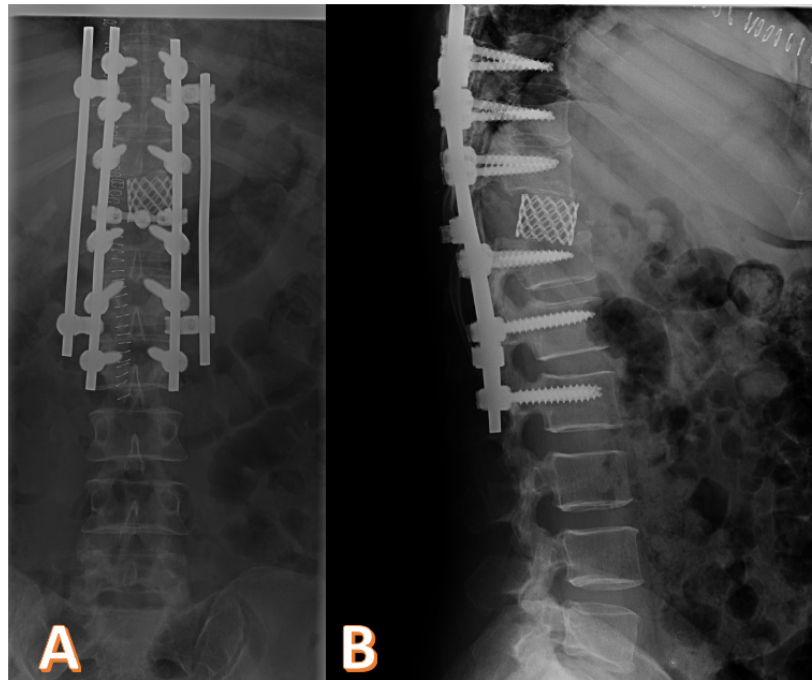
of the spinal cord. The vertebral body was completely relieved of its tumor mass but it was impossible to perform it by en bloc laminectomy and en bloc corpectomy due to post-radiation fibrotic changes.

The reconstruction was made with an expandable cage, and T8 a L2 posterior spinal arthrodesis. The posterior iliac crest constituted the allograft that was utilized to facilitate biologic fusion in combination with demineralized bone matrix.

The patient was placed in lateral decubitus. A wide incision was made in the right fourth intercostal space to expose the 5th rib. The lateral rib margins are divided using guillotine rib shears. We performed a partial 5th rib resection using a Gigli saw with a wide margin. Post-surgical radiographs are shown in **Figure 3**.

Figure 3.

Post-surgical radiographs, anteroposterior (A) and lateral (B) views. Reconstruction with expansible cage and T8-L2 spine arthrodesis.



Motor evoked potentials (MEPs) and somatosensory evoked potentials (SSEPs) were obtained during the procedure. A decrease in both was observed during cage placement. The spinal cord was carefully explored. No compression or stretching lesions were identified. MEP and SSEP spontaneously returned to normal values within minutes. Postoperatively, the patient evolved satisfactorily with functional mobilization and without sensory alterations.

The patient was in intensive care unit around 24 hours. Walking with a thermoplastic back support was started on the second day after surgery. Hospital admission was 5 days, with good evolution on control and motor function.

Histological findings, including macroscopic and microscopic, showed wide margin resection, except for the epidural margin which was marginal.

Three months after surgery, the patient was seen to the emergency department with fever and lumbar pain. The surgical incision showed signs of infection with purulent drainage and redness. Given

the clinical suspicion of postoperative infection, urgent surgical treatment was performed by irrigation and debridement of the necrotic tissue. During the procedure, five tissue specimens were collected for microbiological study. Bacterial growth of *Arcanobacterium* and *Corynebacterium striatum* was observed. The patient was treated for 6 weeks with antibiotherapy, according to antibiogram (amoxicillin-clavulanic acid, vancomycin and linezolid) with good clinical and analytical evolution.

At 1-year follow-up, she has no low back pain or functional limitation. The neurological examination shows no pathological data. Under the supervision of the oncology department, the patient continues treatment with cabozantinib. Follow-up chest-abdomen-pelvis computed CT scan showed absence of disease progression, furthermore, the vertebral arthrodesis shows fusion signs. At the time of this report, there are no clinical or radiological data of infection.

3. Discussion

Metastatic pathologic fractures of the spine can lead to a debilitated state due to severe pain and possible motor weakness. Renal cell carcinoma requires demanding treatment. As better treatments for primary disease become available, patients are living longer; therefore, adequate treatment of secondary disease is needed.

Spinal metastases can be treated by radiation therapy or surgery (Cho, *et al.*, 2015). The gold standard treatment for a solitary spinal metastasis is total en bloc resection (Langdon, *et al.*, 2009). However, the final decision on the type of treatment must be individualized, according to the opinion of the multidisciplinary oncology team (Ortiz-Cruz & Ramos-Pascua, 2020). Our patient presented a bone metastasis at diagnosis with great pain and risk of neuronal injury due to spinal cord instability or invasion. For these reasons, surgical treatment of the primary tumor and radiotherapy for the spine were initially decided.

The use of radiotherapy in these patients remains controversial, RCC is a tumor classically considered as a radioresistant, but advances in radiotherapy technologies have made it possible to administer high doses of radiation with local control that can exceed 90% in the case of SRS (Umer, *et al.*, 2018). The response to radiotherapy is less predictable than in other types of tumors (Umer, *et al.*, 2018, Cho, *et al.*, 2015). In this case, there was a worsening of pain despite radiotherapy treatment, so surgical treatment was considered.

Surgical management depends on the site and number of lesions and estimated survival (Joaquim, *et al.*, 2015). In this case the primary tumor was successfully removed and had only two bone metastases (T11 and 5th rib). The multidisciplinary oncology team decided on surgical treatment with complete tumor resection for clinical and mechanical reasons.

From a clinical point of view, it has been shown that wide resection of a metastasis in renal cell sarcoma, in the absence of primary disease, can increase life expectancy (Ortiz-Cruz & Ramos-Pascua, 2020). The patient was at risk for neuronal compression during her evolution, given that the tumor had already invaded the spinal canal. From the mechanical point of view, the SINS scale revealed a score of 11, surgical stabilization was indicated to avoid spinal cord injury. Surgical treatment is associated with better pain control rates compared to other treatments (radiotherapy or pain unit therapies) (Cho, *et al.*, 2015). This is due to tumor removal, release of the spinal canal and stable vertebral fixation. In addition, quality of life reportedly improves following palliative surgery (Cho, *et al.*, 2015), as in our patient who had a great functional limitation and after surgery was able to walk independently.

However, these are complex surgeries with significant associated morbidity. It is estimated that palliative surgery with vertebral resection only benefits half of the patients (Cho, *et al.*, 2015, Joaquim, *et al.*, 2015). About 25-30% of patients treated with vertebral surgery have some complication. Infection is the most frequent complication, as in the case of our patient (Langdon, *et al.*, 2009, Cho, *et al.*, 2015, Joaquim, *et al.*, 2015). In addition, up to 10% of cases may present intraoperative death (Langdon, *et al.*, 2009, Ortiz-Cruz & Ramos-Pascua, 2020). Therefore, treatment must be individualized for each patient and under the consensus of the multidisciplinary oncology team.

4. Conclusions

As the primary treatment of renal cell carcinoma improves, it is necessary to improve the treatment of secondary disease. The type of treatment will depend on the estimated survival, the quality of life of the patient, as well as the spinal instability and spinal cord compression. Total en bloc vertebrectomy is the gold standard treatment for solitary spinal metastases. The response to radiation therapy is unpredictable in RCC. Although it has been classically considered a radioresistive tumor, new radiation therapies are obtaining better responses.

5. Conflicts of interest

Nothing to declare.

6. Funding

Nothing to declare.

7. Ethical aspects

Written informed consent for patient information and images to be published was provided by the patient.

References

- Cho, J.H. Ha, J.K. Hwang, C.J. Lee, D.H. & Lee, C.S. (2015) Patterns of Treatment for Metastatic Pathological Fractures of the Spine: The Efficacy of Each Treatment Modality. *Clin Orthop Surg*; 7(4):476-82, <https://doi.org/10.4055/cios.2015.7.4.476>
- Giehl, J.P. & Kluba, T. (1999) Metastatic spine disease in renal cell carcinoma indication and results of surgery. *Anticancer Res*; 19(2C):1619-23.
- Joaquim, A.F. Powers, A. Laufer, I. & Bilsky, M.H. (2015) An update in the management of spinal metastases. *Arq Neuropsiquiatr*. 73(9):795-802. <https://doi.org/10.1590/0004-282X20150099>
- Langdon, J. Way, A. Heaton, S. Bernard, J. & Molloy, S. (2009) The management of spinal metastases from renal cell carcinoma. *Ann R Coll Surg Engl*; 91(8):649-52, <https://doi.org/10.1308/003588409X432482>

- Laufer, I. Lorgulescu, J.B. Chapman, T. Lis, E. Shi, W. Zhang, Z. Cox, B.W. Yamada, Y. & Bilsky MH. (2013) Local disease control for spinal metastases following “separation surgery” and adjuvant hypofractionated or high-dose single-fraction stereotactic radiosurgery: outcome analysis in 186 patients. *J Neurosurg Spine*; 18(3):207-14, <https://doi.org/10.3171/2012.11.SPINE12111>
- Laufer, I. Rubin, D.G. Lis, E. Cox, B.W. Stubblefield, M.D. Yamada, Y. & Bilsky, M.H. (2013) The NOMS framework: approach to the treatment of spinal metastatic tumors. *Oncologist*; 8(6):744-51, <https://doi.org/10.1634/theoncologist.2012-0293>
- Les, K.A. Nicholas, R.W. Rougraff, B. Wurtz, D. Vogelzang, N.J. Simon, M.A. & Peabody, T.D. (2001) Local progression after operative treatment of metastatic kidney cancer. *Clin Orthop Relat Res*. (390):206-11, <https://doi.org/10.1097/00003086-200109000-00023>
- McLaughlin, J.K. & Lipworth, L. (2000) Epidemiologic aspects of renal cell cancer. *Semin Oncol*; 27(2):115-23.
- Mendel, E. Bourekas, E. Gerszten, & P. Golan, J.D. (2009) Percutaneous techniques in the treatment of spine tumors: what are the diagnostic and therapeutic indications and outcomes?. *Spine*; 15;34(22Suppl):S93-100, <https://doi.org/10.1097/BRS.0b013e3181b77895>
- Ortiz-Cruz E. & Ramos-Pascua L.R. (2020). Manual de tumores óseos SECOT. 1 ed. Madrid. Fundación SECOT.
- Smith, E.M. Kursh, E.D. Makley, J. & Resnick, M.I. (1992) Treatment of osseous metastases secondary to renal cell carcinoma. *J Urol*; 148:784-7, [https://doi.org/10.1016/s0022-5347\(17\)36719-8](https://doi.org/10.1016/s0022-5347(17)36719-8)
- Tokuhashi, Y. Matsuzaki, H. Oda, H. Oshima, M. & Ryu, J. (2005) A revised scoring system for preoperative evaluation of metastatic spine tumor prognosis. *Spine*; 1;30(19):2186-91, <https://doi.org/10.1097/01.brs.0000180401.06919.a5>
- Tomita, K. Kawahara, N. Baba, H. Tsuchiya, H. Nagata, S. & Toribatake, Y. (1994) Total en bloc spondylectomy for solitary spinal metastases. *Int Orthop*; 18(5):291-8, <https://doi.org/10.1007/BF00180229>
- Tomita, K. Kawahara, N. Kobayashi, T. Yoshida, A. Murakami, H. & Akamaru, T. (2001) Surgical strategy for spinal metastases. *Spine*; 1;26(3):298-306, <https://doi.org/10.1097/00007632-200102010-00016>
- Umer, M. Mohib, Y. Atif, M. & Nazim, M. (2018) Skeletal metastasis in renal cell carcinoma: A review. *Ann Med Surg (Lond)*; 31;27:9-16, <https://doi.org/10.1016/j.amsu.2018.01.002>

RESUMEN

El carcinoma de células renales representa el 2-3% de todas las neoplasias malignas. La enfermedad metastásica de la columna vertebral es frecuente y el 50% de las metástasis óseas ya están presentes en el momento del diagnóstico. Las metástasis óseas del carcinoma de células renales son difíciles de manejar, especialmente en localización vertebral.

Una mujer de 48 años fue diagnosticada de carcinoma de células renales en el contexto de un dolor lumbar. La paciente presentaba dos metástasis óseas en el momento del diagnóstico (T11 y 5ª costilla). Inicialmente recibió tratamiento neoadyuvante con cabozantinib, seguido de la extirpación quirúrgica del tumor renal. Se administró radioterapia para la lesión lumbar. A pesar del tratamiento radioterápico, aumentó el dolor lumbar con limitación para la movilidad

y la deambulaci3n. La RM mostr3 una ocupaci3n del canal espinal, sin lesi3n neurol3gica. La escala SINS revel3 una puntuaci3n de 14 (inestabilidad vertebral). El pron3stico de la paciente era superior a 12 meses seg3n la puntuaci3n de Tokuhashi. Bas3ndose en criterios cl3nicos y mec3nicos, se decidi3 el tratamiento quir3rgico de la lesi3n vertebral. Se realiz3 una vertebrectom3a de T11, para la reconstrucci3n se us3 una caja extensible, junto con una artrodesis vertebral T8-L2. Se realiz3 una resecci3n parcial de la quinta costilla para eliminar todo el tumor macrosc3pico. A los 3 meses de la cirug3a la paciente fue diagnosticada de infecci3n local, tratada mediante irrigaci3n, desbridamiento y antibioterapia, con buena evoluci3n. Al a3o de seguimiento, no presenta dolor lumbar ni limitaci3n funcional. La tomograf3a computarizada de t3rax-abdomen-pelvis de seguimiento mostr3 ausencia de progresi3n de la enfermedad, adem3s, la artrodesis vertebral muestra signos de fusi3n. En el momento de este informe, no hay datos cl3nicos ni radiol3gicos de infecci3n.

Palabras clave: met3stasis espinales, carcinoma de c3lulas renales, inestabilidad espinal, cirug3a de columna.
